

# Delaware Ambient Air Monitoring Network Description for Criteria Pollutants



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**List of Acronyms**

AQS – Air Quality System

CAA – Clean Air Act

CFR – Code of Federal Regulations

CO – carbon monoxide

CSA – combined statistical area

DNREC – Department of Natural Resources and Environmental Control

EPA – Environmental Protection Agency

FEM – Federal Equivalent Method

FRM – Federal Reference Method

MSA – metropolitan statistical area

NAAQS – National Ambient Air Quality Standards

NO – nitric oxide

NO<sub>2</sub> – nitrogen dioxide

NO<sub>x</sub> – nitrogen oxides

O<sub>3</sub> – ozone

Pb - lead

PM<sub>2.5</sub> – fine particulate matter (2.5 microns)

PM<sub>10</sub> – respirable particulate matter (10 microns)

PM<sub>10-2.5</sub> – coarse particulate matter (PM<sub>10</sub> – PM<sub>2.5</sub>)

SLAMS – state and local monitoring stations

SO<sub>2</sub> – sulfur dioxide

WS/WD – wind speed/wind direction

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## Introduction

In 1970, Congress passed the Clean Air Act that authorized the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for pollutants shown to threaten human health and welfare. Primary standards were set according to criteria designed to protect public health, including an adequate margin of safety to protect sensitive populations such as children and asthmatics. Secondary standards were set according to criteria designed to protect public welfare (decreased visibility, damage to crops, vegetation, and buildings, etc.).

Seven pollutants currently have NAAQS: ozone (O<sub>3</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), particulate matter less than 10 microns (PM<sub>10</sub>), particulate matter less than 2.5 microns (PM<sub>2.5</sub>) and lead (Pb). These are commonly called the "criteria" pollutants. When air quality does not meet the NAAQS, the area is said to be in "nonattainment" with the NAAQS.

## Requirements for Monitoring Network Descriptions

In October 2006, the EPA issued final regulations concerning state and local agency ambient air monitoring networks. These regulations require periodic assessments of the monitoring networks including the information described below.

§58.10 Annual monitoring network plan and periodic network assessment.

Section §58.10 (a) requires for each existing and proposed monitoring site:

- 1) A statement of purpose for each monitor.
- 2) Evidence that siting and operation of each monitor meets the requirements of appendices A, C, D, and E of 40 CFR Part 58, where applicable.
- 3) Proposals for any State and Local Air Monitoring station (SLAMS) network modifications.

(b) The annual monitoring network plan must contain the following information for each existing and proposed site:

- 1) The Air Quality System (AQS) site identification number.
- 2) The location, including street address and geographical coordinates.
- 3) The sampling and analysis method(s) for each measured parameter.
- 4) The operating schedules for each monitor.
- 5) Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal.
- 6) The monitoring objective and spatial scale of representativeness for each monitor.
- 7) The identification of any sites that are suitable and sites that are not suitable for comparison against the annual PM<sub>2.5</sub> NAAQS as described in §58.30.
- 8) The Metropolitan Statistical Area (MSA), Core Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor.

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## **Delaware Air Monitoring Network**

### **History of air monitoring in Delaware**

Air pollution monitoring in Delaware began in the 1950s, prior to the establishment of the US EPA. The first monitors were simple mechanisms or passive collectors such as dust-fall buckets and tape samplers. These were followed in the 1960s by wet-chemistry instruments, which were soon replaced by more advanced electronic instruments. The addition of computer technology in operating monitoring systems and air pollution data collection in the late 1970s and early 1980s was critical to the development of the core monitoring network that exists today.

The earliest monitors were placed near pollution sources to measure direct impact of pollution emissions. As ambient air pollution standards became established and monitoring methods standardized, the monitoring network expanded to include monitors in both urban and suburban areas. Monitoring goals shifted to include measuring high pollution concentrations in population centers, detecting trends, and determining compliance with the new national and state air quality standards, as well as establishing background levels and measuring pollution transported from areas outside of Delaware.

With the passage of the Clean Air Act in 1970, and the Clean Air Act Amendments in 1990, various control measures implemented by the federal and state governments resulted in major improvements in air quality, particularly regarding major industrial sources. Pollutants of concern today come from a variety of sources including mobile (both on road and off road vehicles) sources, large industrial facilities, and smaller industries and business. Delaware continues to use its ambient monitoring network to track changes in air quality across the state and evaluate compliance with ambient air quality standards.

### **Network Overview**

The State of Delaware has established an air monitoring network to determine the ambient levels of the pollutants for which NAAQS have been established. The Delaware Air Monitoring Network consists of the sites and monitors listed in this document. Although monitoring takes place statewide, most of the stations are concentrated in the northern urban/industrial areas, which have the highest population and number of pollutant sources. This network is maintained and operated by the Air Surveillance Branch of the Air Quality Management Section, Division of Air and Waste Management, DNREC.

### **National Core Monitoring Strategy – NCore**

In October 2006 the United States Environmental Protection Agency (EPA) issued final amendments to the ambient air monitoring regulations for criteria pollutants. These amendments are codified in 40 CFR parts 53 and 58. The purpose of the amendments was to enhance ambient air quality monitoring to better serve current and future air quality needs. One of the most significant changes in the regulations was the requirement to establish National Core (NCore) multi-pollutant monitoring stations. These stations will provide data on several pollutants at

lower detection limits and replace the National Air Monitoring Station (NAMS) networks that have existed for several years. The final network plan must be submitted to EPA by July 1, 2009 and the stations must be operational by January 1, 2011.

The NCore Network addresses the following monitoring objectives:

- timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms
- support development of emission strategies through air quality model evaluation and other observational methods
- accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors
- support long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards (NAAQS)
- compliance through establishing nonattainment/attainment areas by comparison with the NAAQS
- support multiple disciplines of scientific research, including; public health, atmospheric and ecological

The NCore sites must measure, at a minimum, PM<sub>2.5</sub> particle mass using continuous and integrated/filter-based samplers, speciated PM<sub>2.5</sub>, PM<sub>10-2.5</sub> particle mass, speciated PM<sub>10-2.5</sub>, O<sub>3</sub>, SO<sub>2</sub>, CO, NO/NO<sub>y</sub>, lead (TSP), wind speed, wind direction, relative humidity, and ambient temperature.

Each State is required to operate at least one NCore site. The objective is to locate sites in broadly representative urban (about 50 sites) and rural or regional (about 20 sites) locations throughout the country to help characterize urban- and regional-scale patterns of air pollution. Monitoring agencies are encouraged by EPA to collocate NCore sites with existing sites already measuring ozone precursors, air toxics, or PM<sub>2.5</sub> speciation components. By combining these monitoring programs at a single location, stakeholders can maximize the multi-pollutant information available. This approach not only leverages existing resources but notably enhances the foundation for future health studies and NAAQS revisions.

In 2009, EPA provided funding to begin the process of establishing an NCore station in Delaware. After evaluating the existing network, historical data, census data, meteorology, and topography, Delaware's proposal for the existing MLK monitoring site as Delaware's NCore site was accepted by EPA. The NCore monitoring, including PM<sub>10-2.5</sub>, lead and NO<sub>y</sub>, will be fully operational by January 1, 2011, and the new monitor parameters will be included in the 2011 network plan.

## Monitoring Site Network Map

Below is the Delaware ambient air monitoring site network map as of April 2010.



Below is a summary table with additional information on every SLAMS site in Delaware. Information includes site name, active site monitors, when each monitor began collecting information, the scale of representativeness for each monitor, the monitoring objective, and any other comments relating to the site or monitor.

Site Name & AQS ID	Parameter	Start Date	Scale of Rep	Objective	Comments
Killens Pond 10-001-0002	Ozone - seasonal	4/1/1995	Neighborhood	General/Background	Rural site
	PM2.5	1/1/1999	Neighborhood	General/Background	
	WS/WD	4/1/1995	N/A		
Dover 10-001-0003	PM2.5	1/1/1999	Neighborhood	Population Exposure	
	PM2.5 speciation	6/1/2001	N/A		
Brandywine 10-003-1010	Ozone - seasonal	7/1/1994	Neighborhood	Population Exposure	Secondary downwind of Wilm.
Bellefonte2 10-003-1013	Ozone	4/1/2001	Neighborhood	Population Exposure	Primary downwind of Wilm.
	SO2	3/1/2003	Neighborhood		
Bellefonte 10-003-1003	PM2.5	1/1/1999	Neighborhood	Population Exposure	
MLK 10-003-2004	SO2	1/1/1999	Neighborhood		Urban site
	CO	1/1/1999	Middle	Maximum concentration	
	NO2	1/1/2001	Neighborhood	Maximum concentration	
	PM10	1/1/2000	Neighborhood	Maximum concentration	
	PM2.5	1/1/1999	Neighborhood	Maximum concentration	
	PM2.5 speciation	6/1/2001	N/A		
	BC	1/1/2001	N/A		
	VOCs	1/1/1999	N/A		
	Carbonyls	1/1/2003	N/A		
	Metals	1/1/2003	N/A		
	WS/WD	6/1/2000	N/A		
Newark 10-003-1012	PM2.5	12/15/1999	Neighborhood	Population Exposure	
Lums Pond 10-003-1007	Ozone	1/1/1992	Neighborhood	Upwind/Background	Rural/suburban
	PM2.5	1/1/1999	Neighborhood	Transport/Background	

Site Name & AQS ID	Parameter	Start Date	Scale of Rep	Objective	Comments
Delaware City 10-003-1008	SO <sub>2</sub>	2/1/1992	Neighborhood		Point source dominated site
	CO	1/1/1994	Middle		
	VOCs	1/1/2001	N/A		
	WS/WD		N/A		
Seaford 10-005-1002	Ozone - seasonal	3/1/1990	Neighborhood	Population Exposure	
	PM <sub>2.5</sub>	1/1/1999	Neighborhood	Population Exposure	
	WS/WD		N/A		
Lewes 10-005-1003	Ozone - seasonal	5/1/1997	Neighborhood	Population Exposure	Coastal site
	WS/WD	6/1/1997	N/A		

N/A – not applicable

## Criteria Pollutant Network Description by Parameter

### Ozone (O<sub>3</sub>)

Ozone is measured by ultraviolet absorption photometry. Air is drawn through a sample cell where ultraviolet light (254 nm wavelength) passes through it. Light not absorbed by the ozone is converted into an electrical signal proportional to the ozone concentration.

### Monitoring Requirements

Within an O<sub>3</sub> network, at least one O<sub>3</sub> site for each MSA, or CSA if multiple MSAs are involved, must be designed to record the maximum concentration for that particular metropolitan area. More than one maximum concentration site may be necessary in some areas. Other types of monitoring sites are needed to determine maximum population exposure, background concentrations, and concentrations being transported into an area (boundary conditions). The appropriate spatial scales for O<sub>3</sub> sites are neighborhood, urban, and regional. Since O<sub>3</sub> requires appreciable formation time, the mixing of reactants and products occurs over large volumes of air, and this reduces the importance of monitoring small scale spatial variability.

The prospective maximum concentration monitor site should be selected in a direction from the city that is most likely to observe the highest O<sub>3</sub> concentrations, more specifically, downwind during periods of photochemical activity. Since O<sub>3</sub> levels decrease significantly in the colder parts of the year in many areas, O<sub>3</sub> is required to be monitored only during the “ozone season” as designated in the 40 CFR Part 58 Appendix D, which in Delaware is April 1 through October 31.



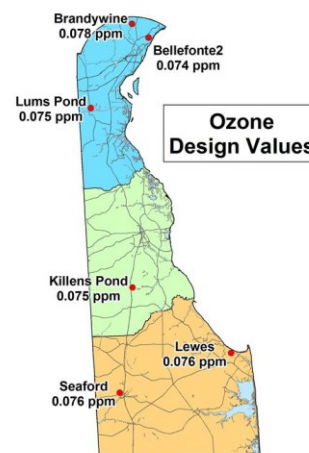
Delaware operates six ozone monitoring sites, including sites for maximum downwind concentrations, background concentrations, and transport conditions. The monitors at Bellefonte

and Lums Pond operate year-round, while the remaining sites operate during the ozone season (April through October). Hourly data is sent to the AirNow website to generate the daily Air Quality Index and to be used in mapping ozone concentrations throughout the region.

### ***Ozone Design Values***

The table below shows the most recent (2007 – 2009) design values for ozone monitors in Delaware. Ozone design values are calculated by taking the 3-year average of the annual 4th maximum daily maximum 8-hr ozone averages. The current 8-hr ozone standard is 0.08 ppm. On January 6, 2010, EPA proposed strengthening the 8-hour standard to the range of 0.060 – 0.070 ppm; the final rule is will be promulgated by August 31, 2010. All ozone monitors in Delaware will exceed the new standard based on the most recent design values as shown in the table below.

Site	Design Value ppm
Brandywine	0.078
Bellefonte2	0.074
Lums Pond	0.075
Killens Pond	0.075
Seaford	0.076
Lewes	0.076



### ***Sulfur Dioxide (SO<sub>2</sub>)***

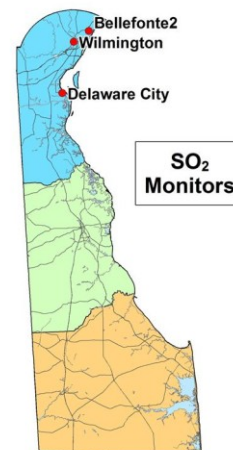
Sulfur dioxide is measured with a fluorescence analyzer. Air is drawn through a sample cell where it is subjected to high intensity ultraviolet light. This causes the sulfur dioxide molecules in the air to fluoresce and release light. The fluorescence is detected with a photo multiplier tube and converted to an electrical signal proportional to the SO<sub>2</sub> concentration.

### ***Monitoring Requirements***

There are no minimum requirements for the number of SO<sub>2</sub> monitoring sites. Continued operation of existing SO<sub>2</sub> sites is required until discontinuation is approved by the EPA Regional Administrator. Where SO<sub>2</sub> monitoring is ongoing, at least one of the SO<sub>2</sub> sites must be a maximum concentration site for that specific area.

The appropriate spatial scales for SO<sub>2</sub> monitoring are the micro, middle, and possibly neighborhood scales.

Delaware operates three SO<sub>2</sub> monitoring sites, all in New Castle County. All sites operate year-round. Please see the section on “Changes from 2009” for more information on SO<sub>2</sub> sites.

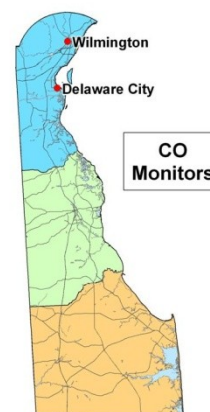


### Carbon Monoxide (CO)

Carbon monoxide is measured by infrared absorption photometry. Air is drawn continuously through a sample cell where infrared light passes through it. Carbon monoxide molecules in the air absorb part of the infrared light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of carbon monoxide in the sample cell.

#### *Monitoring Requirements*

There are no minimum requirements for the number of CO monitoring sites. Continued operation of existing CO sites is required until discontinuation is approved by the EPA Regional Administrator. Where CO monitoring is ongoing, at least one site must be a maximum concentration site for that area under investigation.



Delaware operates two CO monitoring sites; monitors operate year-round.

### Nitrogen Dioxide (NO<sub>2</sub>)

Nitrogen oxides are measured using the chemiluminescence reaction of nitric oxide (NO) with ozone (O<sub>3</sub>). Air is drawn into a reaction chamber where it is mixed with a high concentration of ozone from an internal ozone generator. Any NO in the air reacts with the ozone to produce NO<sub>2</sub>. Light emitted from this reaction is detected with a photo multiplier tube and converted to an electrical signal proportional to the NO concentration. NO<sub>2</sub> must be measured indirectly. NO<sub>x</sub> is measured by passing the air through a converter where any NO<sub>2</sub> in the air is reduced to NO before the air is passed to the reaction chamber. By alternately passing the air directly to the reaction chamber, and through the converter before the reaction chamber, the analyzer alternately measures NO and NO<sub>x</sub>. The NO<sub>2</sub> concentration is equal to the difference between NO and NO<sub>x</sub>.



#### *Monitoring Requirements*

There are no minimum requirements for the number of NO<sub>2</sub> monitoring sites. Continued operation of existing NO<sub>2</sub> sites is required until discontinuation is approved by the EPA Regional Administrator. Where NO<sub>2</sub> monitoring is ongoing, at least one NO<sub>2</sub> site in the area must be located to measure the maximum concentration of NO<sub>2</sub>.

Delaware operates one NO<sub>2</sub> site at MLK in Wilmington. The NCore program will require the addition of NO<sub>y</sub> monitoring by January 1, 2011 at this site.

**Particulate Matter - Fine (PM<sub>2.5</sub>)**

The federal reference method (FRM) monitors for PM<sub>2.5</sub> operate by drawing air through a specially designed inlet that excludes particles larger than 2.5 microns in diameter. The particles are collected on a Teflon<sup>®</sup> microfiber filter that is weighed to determine the particulate mass.

Delaware operates PM<sub>2.5</sub> monitors at seven sites throughout the state. All monitors operate year-round. There is one collocated site at MLK in Wilmington. The normal sampling schedule is 24 hours every third day, however, at MLK samples are collected every day.

**Monitoring Requirements**

State agencies must operate at least the minimum number of required PM<sub>2.5</sub> sites listed in 40 CFR Part 58 Appendix D Table D-5. These required monitoring stations or sites must be sited to represent community-wide air quality. In addition, the following specific criteria apply:

- (1) At least one monitoring station is to be sited in a population-oriented area of expected maximum concentration.
- (2) For areas with more than one required station, a monitoring station is to be sited in an area of poor air quality.
- (3) Each State shall install and operate at least one PM<sub>2.5</sub> site to monitor for regional background and at least one PM<sub>2.5</sub> site to monitor regional transport.

**PM<sub>2.5</sub> Speciation**

Chemical speciation is encouraged at sites where the chemically resolved data would be useful in developing State implementation plans and supporting atmospheric or health effects related studies. These sites in Delaware are MLK in Wilmington and Dover in Kent County. The PM<sub>2.5</sub> chemical speciation sites include analysis for elements, selected anions and cations, and carbon.

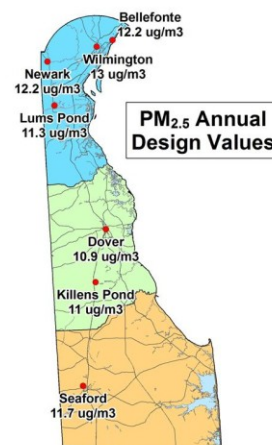
**Continuous PM<sub>2.5</sub>**

Delaware operates a continuous PM<sub>2.5</sub> monitor that generates FRM-like hourly and 24-hour data at the MLK site. This monitor operates year-round, and is collocated with an FRM PM<sub>2.5</sub> monitor. Continuous PM<sub>2.5</sub> data had formerly been collected at Newark, Killens Pond, and Seaford using different monitoring methodology. The data collected with that instrumentation did not consistently compare well with the FRM data. Consequently, operation of these monitors has been temporarily suspended to work with the manufacture on improving performance.

***PM<sub>2.5</sub> Annual Design Values (2007 – 2009)***

Below are the current annual design values for PM<sub>2.5</sub> using 2006 through 2008 data. PM<sub>2.5</sub> annual design values are calculated using the 3-year average of the respective annual averages. The current annual PM<sub>2.5</sub> standard is 15 µg/m<sup>3</sup>.

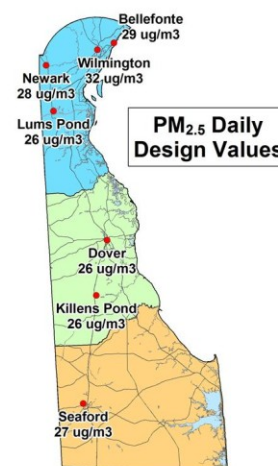
Site	Design Value µg/m <sup>3</sup>
Bellefonte	12.2
MLK – Wilmington	13.0
Newark	12.2
Lums Pond	11.3
Dover	10.9
Killens Pond	11.0
Seaford	11.7

***PM<sub>2.5</sub> Daily Design Values (2007 - 2009)***

Below are the current daily design values for PM<sub>2.5</sub> using 2006 through 2008 data. PM<sub>2.5</sub> daily design values are calculated using the 3-year average of the annual 98th percentile values. As of 2006, the new, more stringent daily PM<sub>2.5</sub> standard is 35 µg/m<sup>3</sup>. The previous daily standard was 65 µg/m<sup>3</sup>. Final designations relative to the new standard will be required by December 2009 (becoming effective in April 2010), based upon measured data from 2006 through 2008.

Currently, under the 1997 PM<sub>2.5</sub> NAAQS, all Delaware monitors are measuring attainment for both the annual and daily PM<sub>2.5</sub> standards. However, New Castle County is currently designated nonattainment for the annual standard as part of the Philadelphia nonattainment area.

Site	Design Value µg/m <sup>3</sup>
Bellefonte	29
MLK – Wilmington	32
Newark	28
Lums Pond	26
Dover	26
Killens Pond	26
Seaford	27



**Particulate Matter (PM<sub>10</sub>)**

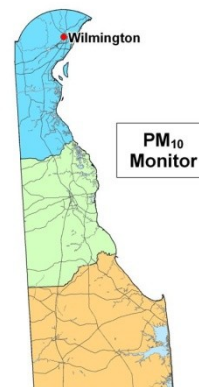
PM<sub>10</sub> is sampled continuously using a tapered element oscillating microbalance (TEOM). Air is drawn through a specially designed inlet that excludes particles larger than 10 microns in diameter. Particle accumulation causes changes in the microbalance oscillation which are recorded by the instrument.

**Monitoring Requirements**

State, and where applicable local, agencies must operate the minimum number of required PM<sub>10</sub> monitoring sites listed in Table D-4 of 40 CFR Part 58 Appendix D. For Delaware this requires at least one site in the urban Wilmington area.

Although microscale monitoring may be appropriate in some circumstances, the most important spatial scales to effectively characterize the emissions of PM<sub>10</sub> from both mobile and stationary sources are the middle scales and neighborhood scales.

Delaware operates one PM<sub>10</sub> monitor at MLK in Wilmington.

**Changes from 2009**

SO<sub>2</sub> monitoring at Lums Pond was ended in 2008 due to continuing problems with monitor operation. The age of the monitor and high cost of replacement resulted in the suspension of SO<sub>2</sub> monitoring at that site. In 2010 resources became available to purchase new equipment, and monitoring is expected to resume before the end of the year.

**Changes anticipated for 2010**

- SO<sub>2</sub> monitoring will be reinstated at Lums Pond.
- NCore monitoring will begin during 2010 and be fully operational by January 1, 2011.

**Individual Monitoring Site Information**

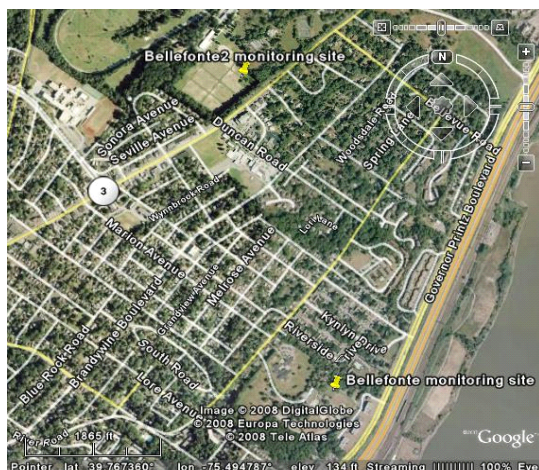
The following pages contain additional site specific information on all active SLAMS monitoring sites in Delaware. Sites are shown in alphabetical order for New Castle, Kent, and Sussex Counties.

**Site: Bellefonte and Bellefonte2**

County:	New Castle	Latitude:	Bellefonte 39.7611 Bellefonte2 39.7739
Address:	Bellefonte: River Road Park Bellefonte2: Bellevue State Park	Longitude:	Bellefonte -75.4919 Bellefonte2 - 75.4964
AQS site ID:	Bellefonte: 10-003-1003 Bellefonte2: 10-003-1013	Year Established:	Bellefonte 1969 Bellefonte2 2001
Spatial Scale:	Neighborhood	Area Represented:	Wilmington area



Bellefonte and Bellefonte2 locations



Bellefonte2

**Monitored Parameters**

	Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
Bellefonte					X					
Bellefonte2	X	X								

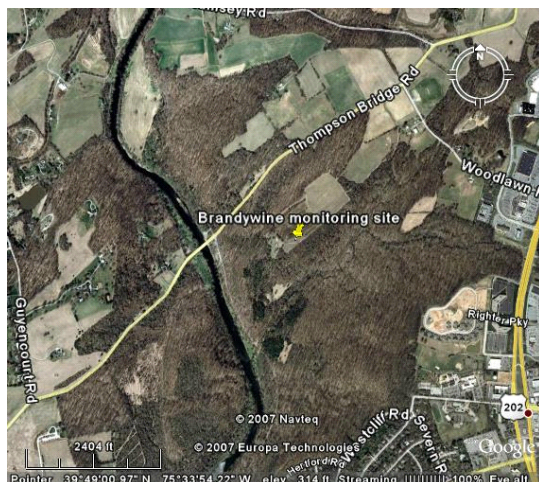
**Site Description:** Bellefonte was originally established in 1969 to monitor O<sub>3</sub> and SO<sub>2</sub>. PM<sub>2.5</sub> was added in 1999. When changing site characteristics began to interfere with ozone monitoring, a new site (Bellefonte2) was established in 2001, less than a mile to the north. The O<sub>3</sub> and SO<sub>2</sub> monitors were relocated to the new site, while the PM<sub>2.5</sub> monitor remained at the original site to provide data continuity. Both sites meet all EPA siting criteria.

**Monitoring Objectives:** Both monitoring sites are neighborhood scale, and collect data to determine compliance with the NAAQS, to determine population exposures, and to track trends. Bellefonte2 is the O<sub>3</sub> maximum downwind concentration site for Wilmington. The SO<sub>2</sub> monitor is sited for general population exposure and trends, with major point sources located to the northeast in Marcus Hook, PA and to the south in Edgemoor.

**Planned Changes through 2010:** No changes planned.

**Site: Brandywine**

County: New Castle Latitude: 39.8172  
 Address: Brandywine Creek State Park Longitude: -75.5639  
 AQS site ID: 10-003-1010 Year Established: 1994  
 Spatial Scale: Neighborhood Area Represented: Wilmington area



**Station Photo Not Available**

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X									

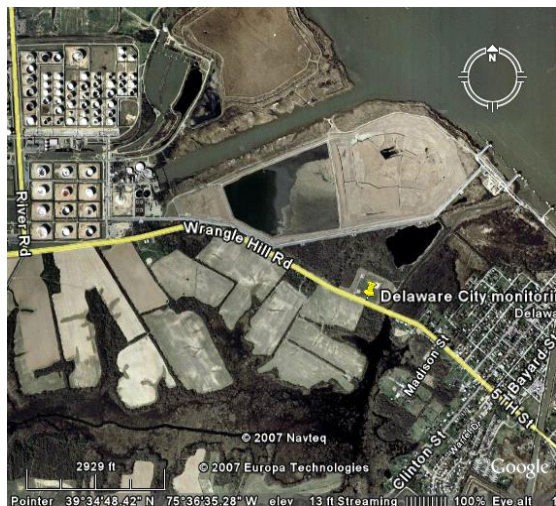
**Site Description:** The Brandywine site is located in Brandywine Creek State Park. This is a neighborhood scale site for O<sub>3</sub> monitoring. The site meets all EPA siting requirements.

**Monitoring Objectives:** The Brandywine site is in the secondary downwind direction from Wilmington. The objectives are compliance with the O<sub>3</sub> NAAQS, population exposure, and trends.

**Planned Changes through 2010:** No changes are planned.

**Site: Delaware City**

County: New Castle      Latitude: 39.5778  
 Address: Route 9, Delaware City      Longitude: -75.6111  
 AQS site ID: 10-003-1008      Year Established: 1992  
 Spatial Scale: Neighborhood      Area Represented: Delaware City

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
	X	X						X	X

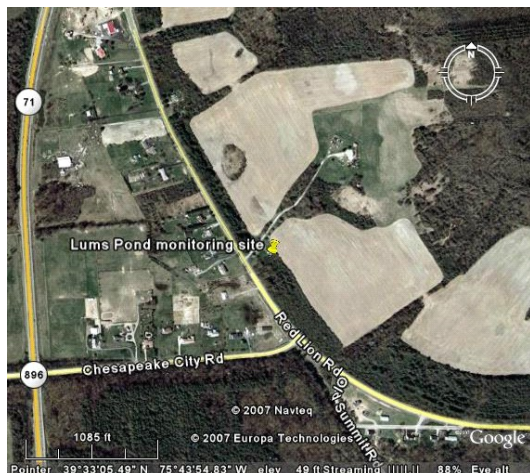
**Site Description:** The Delaware City site was established at a location along Route 9 that is between the Delaware City industrial complex and the nearest populated area (Delaware City) in the predominant downwind direction. This site meets all EPA siting criteria.

**Monitoring Objectives:** This monitoring site is a stationary source-impacted site for SO<sub>2</sub>. The monitoring objectives are compliance with the NAAQS, population exposure, and trends.

**Planned Changes through 2010:** No changes planned.

**Site: Lums Pond**

County:	New Castle	Latitude:	39.5511
Address:	Lums Pond State Park	Longitude:	-75.7308
AQS site ID:	10-003-1007	Year Established:	1999
Spatial Scale:	Neighborhood	Area Represented:	Wilmington area

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X	TBD			X					

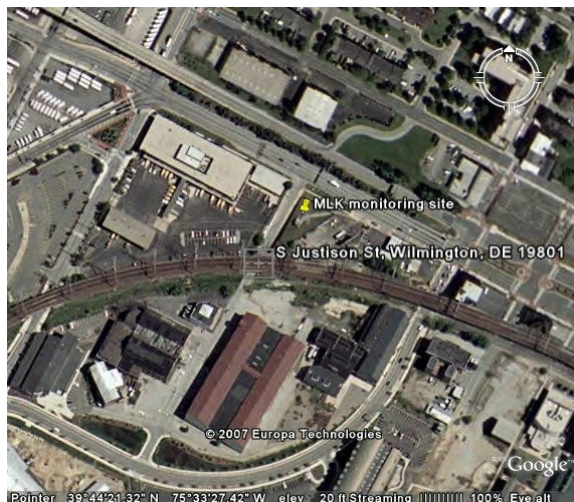
**Site Description:** The Lums Pond site is a neighborhood scale site located in a general upwind direction from Wilmington. The immediate area is rural. The site meets all EPA siting criteria.

**Monitoring Objectives:** The site objectives for O<sub>3</sub> are NAAQS compliance, regional transport, population exposure, and trends. This site was originally planned to monitor O<sub>3</sub> transported into Delaware from the Baltimore/Washington area, and continues to serve this purpose. The SO<sub>2</sub> monitor was added 2000 to detect impacts from major point sources directly to the east. PM<sub>2.5</sub> monitoring began in 1999 as both a transport and general population exposure site, as well as for NAAQS compliance. All parameters are neighborhood scale.

**Planned Changes through 2010:** SO<sub>2</sub> monitoring will be reinstated by the end of 2010.

**Site: MLK**

County:	New Castle	Latitude:	39.7394
Address:	Justison St. and MLK Blvd	Longitude:	-75.5581
AQS site ID:	10-003-2004	Year Established:	1999
Spatial Scale:	Neighborhood	Area Represented:	Wilmington

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction	NO/NO <sub>y</sub>	Lead	PM <sub>10-2.5</sub>
	X	X	X	X	X	X	X	X	X			

**Site Description:** The MLK site is located in Wilmington at the intersection of Justison St. and MLK Blvd. It replaced another urban site at 12<sup>th</sup> and King Streets that had operated at that location for over 20 years. The MLK site represents urban population exposure to multiple pollution sources. The site meets all EPA siting criteria.

**Monitoring Objectives:** Monitoring objectives are compliance with the NAAQS, maximum population exposure, and trends.

**Planned Changes through 2010:** NCore monitoring will begin during 2010 with all monitors fully operational by January 1, 2011.

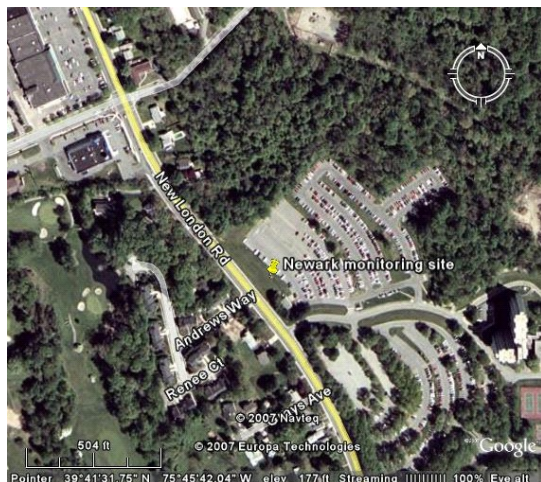
**Site: Newark**

County: New Castle  
 Address: University of Delaware North Campus

Latitude: 39.6919  
 Longitude: -75.7617

AQS site ID: 10-003-1012  
 Spatial Scale: Neighborhood

Year Established: 1999  
 Area Represented: Newark

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
				X					

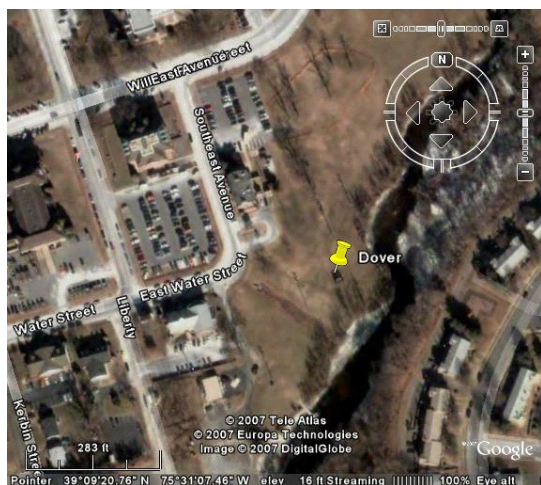
**Site Description:** The Newark site is a platform only. It is a PM<sub>2.5</sub> neighborhood scale site. The location is suburban and generally impacted by mobile sources and regional transport. The site meets all EPA siting criteria.

**Monitoring Objectives:** The objectives are NAAQS compliance, regional transport, population exposure, and trends.

**Planned Changes through 2010:** No changes planned.

**Site: Dover**

County:	Kent	Latitude:	39.155
Address:	Water St.	Longitude:	-75.5181
AQS site ID:	10-001-0003	Year Established:	1999
Spatial Scale:	Neighborhood	Area Represented:	Dover

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
				X	X				

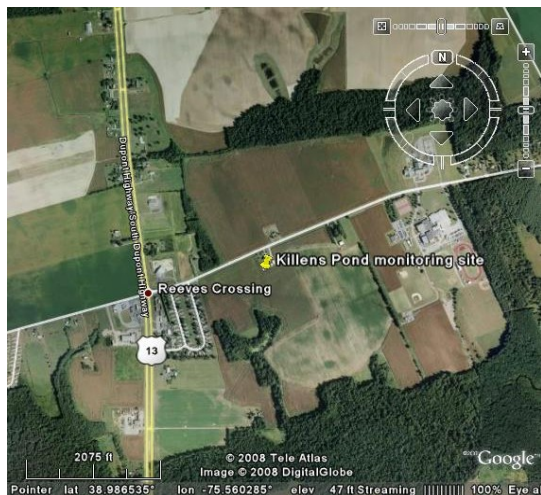
**Site Description:** The Dover site is a platform only. It is a neighborhood scale site representative of the Dover area, and is impacted by a combination of source types including mobile, large and small point sources. The site meets all EPA siting criteria.

**Monitoring Objectives:** The monitoring objectives are NAAQS compliance, population exposure, and trends.

**Planned Changes through 2010:** No changes planned.

**Site: Killens Pond**

County: Kent Latitude: 38.9847  
 Address: Killens Pond Rd. Longitude: -75.5555  
 AQS site ID: 10-001-0002 Year Established: 1995  
 Spatial Scale: Neighborhood Area Represented: Not in an urban area

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X				X				X	X

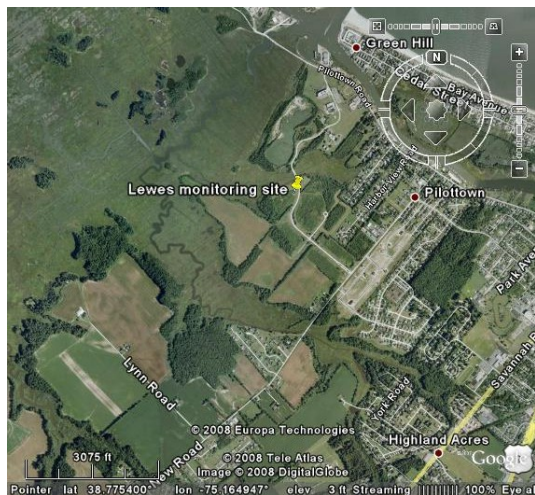
**Site Description:** The Killens Pond site is located in a rural area that is part of Killens Pond State Park. The site meets all EPA siting criteria.

**Monitoring Objectives:** The objectives for this site are background concentrations, NAAQS compliance, and trends.

**Planned Changes through 2010:** No changes planned.

**Site: Lewes**

County: Sussex Latitude: 38.7792  
 Address: University of Delaware College of Marine Studies Longitude: -75.1631  
 AQS site ID: 10-005-1003 Year Established: 1997  
 Spatial Scale: Neighborhood Area Represented: Lewes

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X								X	X

**Site Description:** The Lewes site is neighborhood scale. It is near the University of Delaware College of Marine Studies campus in Lewes, and is representative of the coastal Sussex County area. The site meets all EPA siting criteria.

**Monitoring Objectives:** The objectives include NAAQS compliance, population exposure, and trends.

**Planned Changes through 2010:** No changes planned.

**Site: Seaford**

County:	Sussex	Latitude:	38.6444
Address:	350 Virginia Ave.	Longitude:	-75.6131
AQS site ID:	10-005-1002	Year Established:	1990
Spatial Scale:	Neighborhood	Area Represented:	Seaford

**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X				X				X	X

**Site Description:** The Seaford site was originally located further south, near the Seaford water tower. It was relocated to the present location in 1990 due to deteriorating conditions at the original site. The current site is neighborhood scale and is suburban. The site is impacted by local point sources, mobile sources, and regional transport. The site meets all EPA siting criteria.

**Monitoring Objectives:** The site objectives are NAAQS compliance, population exposure, and trends.

**Planned Changes through 2010:** No changes planned.

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**Monitoring method information**

Monitoring methods and associated AQS codes used in the Delaware ambient air monitoring network:

Parameter	AQS Method Code	Method Description
O <sub>3</sub>	047, 091	UV Absorption
SO <sub>2</sub>	092	UV Fluorescence
CO	054	Non-dispersive Infrared
NO <sub>2</sub>	074	Chemiluminescence
PM <sub>2.5</sub>	155	Gravimetric
PM <sub>10</sub>	079	TEOM Gravimetric
WS/WD	050	Ultrasonic

**Ozone (O<sub>3</sub>)**

Ozone is measured by ultraviolet absorption photometry. Air is drawn through a sample cell where ultraviolet light (254 nm wavelength) passes through it. Light not absorbed by the ozone is converted into an electrical signal proportional to the ozone concentration.

**Sulfur Dioxide (SO<sub>2</sub>)**

Sulfur dioxide is measured with a fluorescence analyzer. Air is drawn through a sample cell where it is subjected to high intensity ultraviolet light. This causes the sulfur dioxide molecules in the air to fluoresce and release light. The fluorescence is detected with a photo multiplier tube and converted to an electrical signal proportional to the SO<sub>2</sub> concentration.

**Carbon Monoxide (CO)**

Carbon monoxide is measured by infrared absorption photometry. Air is drawn continuously through a sample cell where infrared light passes through it. Carbon monoxide molecules in the air absorb part of the infrared light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of carbon monoxide in the sample cell.

**Nitrogen Dioxide (NO<sub>2</sub>)**

Nitrogen oxides are measured using the chemiluminescence reaction of NO with O<sub>3</sub>. Air is drawn into a reaction chamber where it is mixed with a high concentration of ozone from an internal ozone generator. Any NO in the air reacts with the ozone to produce NO<sub>2</sub>. Light emitted from this reaction is detected with a photo multiplier tube and converted to an electrical signal proportional to the NO concentration. NO<sub>2</sub> must be measured indirectly. NO<sub>x</sub> are measured by passing the air through a converter where any NO<sub>2</sub> in the air is reduced to NO before the air is passed to the reaction chamber. By alternately passing the air directly to the

reaction chamber, and through the converter before the reaction chamber, the analyzer alternately measures NO and NO<sub>x</sub>. The NO<sub>2</sub> concentration is equal to the difference between NO and NO<sub>x</sub>.

**Particulate Matter - Fine (PM<sub>2.5</sub>)**

PM<sub>2.5</sub> is sampled by drawing air through a specially designed inlet that excludes particles larger than 2.5 microns in diameter. The particles are collected on a Teflon<sup>7</sup> microfiber filter that is weighed to determine the particulate mass. The normal sampling schedule is 24 hours every third day, however, at one site (Wilmington-MLK) samples are collected for 24 hours every day.

**Particulate Matter (PM<sub>10</sub>)**

PM<sub>10</sub> is sampled continuously using a tapered element oscillating microbalance (TEOM). Air is drawn through a specially designed inlet that excludes particles larger than 10 microns in diameter. Particle accumulation causes changes in the microbalance oscillation which are recorded by the instrument.